

The Kusky Op-Ed: Serious Errors of Fact and Logic

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On September 25, 2005, The Boston Globe published an op-ed commentary by Dr. Timothy M. Kusky captioned "Time to move to higher ground" (attached), in which he argues: "New Orleans is sinking unbearably below sea level, and it's time to move to higher ground." Kusky used the same estimates and projections in his appearance on the CBS program *Sixty Minutes* on November 20. The following is a critical examination of the facts and logic that Kusky used in the op-ed to support his conclusion.

1. **Kusky:** *New Orleans is located on a coastal delta basin up to 10 feet below sea level and still sinking as much as one inch per year.*

Critical examination: There is much imbedded in that sentence that requires clarification and examination:

- a. New Orleans is located on a deltaic plain over upper portion of the Holocene depositional basin of the Mississippi River. It is underlain with only 30-70 feet of unconsolidated delta deposits in contrast to as much as 350 feet in the lower delta near the Gulf of Mexico.¹
- b. Although the majority of the developed portion of the city is below sea level, only a small part (estimated to be about 10-15%) is 10 feet or more below sea level.² Other portions of the city near the Mississippi River are 10 feet or more above sea level.
- c. According to a recent National Geodetic Survey (NGS) report, the rate of loss of land elevation (sinking rate) in New Orleans has varied generally within the range of 0.16 to 0.6 inches per year³. Subsidence rates of 1 inch per year were generally found only in the outer portions of the delta, particularly atop roadways or levees, which produce mass loading on underlying sediments.
- d. Many geologists have questioned these new subsidence estimates as being as much as an order of magnitude too high.⁴
- e. Another USGS/NOAA study based on releveing data reported that the regions of the city built on natural alluvial deposits lost an average of about 8 inches in elevation between 1951 and 1995⁵. Portions of the city that occupy

¹ Frazier, D. E., 1967. Recent deltaic deposits of the Mississippi River: their development and chronology: *Gulf Coast Association of Geological Societies Transactions* 27:287-315.

² Campanella, R. 2002. *Time and Place in New Orleans: Past Geographies in the Present Day*. Pelican Publishing, Gretna, LA.

³ Shinkle, K.D. and R.K. Dokka, 2004. *Rates of Vertical Displacement at Benchmarks in the Lower Mississippi Valley and the Northern Gulf Coast*. NOAA Technical Report NOS/NGS 50.

⁴ Sever, M. 2005. Confusion over sinking coasts in the Gulf. *Geotimes*, August 2005.

⁵ Burkett, V.R., D.B. Zikoski, and D.A. Hart. 2003. Sea-level rise and subsidence: implications for flooding in New Orleans, Louisiana, pp. 63-70. In: *U.S. Geological Survey Subsidence Interest Group Conference, Proceedings for the Technical Meeting* USGS Water Resources Division, Open File Report Series 03-308.

drained lake-fringe swamps, including those neighborhoods most below sea level, lost an average of 17 inches in elevation during that time period.

2. **Kusky:** *Much of the city could be 18 feet below sea level by the end of the century*

Critical examination: Kusky appears to have estimated 18 feet by assuming 1 inch per year of sinking over the rest of the year and adding that to the “up to 10 feet” below sea level mentioned earlier. This is highly questionable for the following reasons:

- a. Even using the controversial NGS estimates, the sinking rate for most of New Orleans has been much less than one-half inch per year. By assuming a 1 inch per year sinking rate, Kusky overestimates average sinking rates observed in the NOAA/USGS study by a factor of 3 to 5.
- b. The most rapidly sinking areas are the neighborhoods located on drained lake-fringe swamps (Lakeview to New Orleans East). The USGS/NOAA study found an average loss of elevation in those areas of 17 inches between 1951 and 1995. Extrapolating this trend would yield a loss of elevation of under 3, not 8, feet over the next 90 years. Applying Kusky’s logic, then, it would be the mid 23rd century, rather than the end of the 21st century when just the current low spots would reach 18 feet below sea level (excluding as Kusky did a rise in sea level). Because most of the city is higher than -4 feet elevation and appears to be subsiding at a rate closer to 0.25 inches per year, it would take over 600 years for most of the city to be lower than 18 feet below sea level.
- c. There are good reasons to believe that the rate of sinking for the low-lying areas will slow down. These areas were swamps, originally barely above sea level, that were drained for development beginning in the early 20th century. As they were drained, the highly organic soils rapidly lost volume due to dewatering, oxidation of organic matter, and compaction. Most of the resulting 4-10 feet of loss in elevation occurred prior to the 1951 leveling measurements. Because such very rapid sinking is a phenomenon of near-surface soil compaction, the rates should gradually approach those of alluvial units, which are governed primarily by deeper geological processes. Furthermore, land drainage practices that could be implemented to reduce the rate of elevation loss.

3. **Kusky:** *A total land area the size of Manhattan is disappearing every year, meaning that New Orleans will be right on the Gulf Coast by the end of the century.*

Critical examination: Although the average annual amount of land lost in coastal Louisiana over the past decade has been less than the land area of Manhattan (30 square miles), the land lost over the past 50 years is indeed alarming. Furthermore, Hurricanes Katrina and Rita appear to have caused a number of years’ worth of land loss in just one month. However, Kusky’s implicit projection of the retreat of the shoreline is more extreme than estimated in detailed technical assessments⁶ and ignores plans that have been developed to slow, and where possible reverse, the rate of coastal land loss. The National Research Council has recently affirmed that

⁶ Barras, J., S. Beville, D. Britsch and 11 others. 2004. *Historical and Projected Coastal Louisiana Land Changes: 1978-2050*. USGS Open File Report OFR 03-334.

such a restoration approach is feasible if it is substantial, sustained and strategic.⁷ New Orleans, itself, is in a fortuitous position relative to other parts of the Louisiana coast in that it is in the inner part of the deltaic plane, adjacent to higher ground, and sits on the banks of the Mississippi River and the sediment supply needed for nourishing sinking wetlands and building new landscapes.

4. **Kusky:** *The city will look like a fish tank battered by coastal waves, surrounded by 50- to 100-foot-high seawalls that are barely able to protect it from hurricanes that are only as strong as Katrina.*

Critical examination: It is unlikely that even levees designed to protect from category 5 hurricanes would exceed a maximum of 30 feet above sea level. Measured from inside the levees, that would be not greater than 43 feet, or 45 feet accounting for probable sea-rise during the 20th century. The Mississippi River levee is currently higher than 50 feet in some places.

5. **Kusky:** *The levees have an additional collateral effect that may doom the future of New Orleans. A river confined by levees builds its base higher than without levees. Catastrophic floods occur when the river base rises tens of feet above the flood plains, then breaks through the levees. The Chinese know this from their history of flooding along the Yellow River, known as the River of Sorrow after the millions of people who have died there, more than from any other natural disaster in the world.*

Critical examination: Extensive multibeam bathymetric surveys coupled with bottom sampling in the New Orleans region of the lower Mississippi River by Dr. Meade Allison of Tulane University document that the river is eroding into Pleistocene deposits and not building its base by sediment deposition as is the Yellow River. The average water flow of the Mississippi is approximately seven times that of the Yellow, while its sediment load is only about one-third. This explains why the bed of the Yellow River is depositional and that of the Mississippi is not. To the contrary, a problem for the lower Mississippi delta is the decline in the volume of sediments transported by the river as a result of trapping behind dams upriver, particularly along the Missouri River.

6. **Kusky:** *The river is ready to switch its course to follow the Atchafalaya, offering it a shorter route to the gulf. When this occurs, perhaps triggered by catastrophic flooding and a drenching hurricane, it will be devastating to the lower delta, which will quickly subside.*

Critical examination: It has been over half a century since scientists identified the likelihood that the Atchafalaya River would capture a growing portion of the flow of the Mississippi River.⁸ Massive control structures have been put in place to maintain a portion of the flow down the Atchafalaya and prevent switching. By stating not “if” but “will” Kusky refers to course switching as if it were a foregone conclusion when, in fact, it is unlikely.

⁷ National Research Council. 2005. *Drawing Louisiana's New Map: Addressing Land Loss in Coastal Louisiana*. National Academies Press, Washington, DC.

⁸ Fisk, H.N. 1952. *Geological Investigation of the Atchafalaya Basin and Problems of the Mississippi River Diversion*. Vicksburg: U.S. Army Corps of Engineers, Mississippi River Commission, 145 pp..

7. **Kusky:** *The river is rising, and more hurricanes and floods are certain to strike the region in the next 100 years.*

Critical examination: As explained above, the bed of the river is not rising. While additional hurricanes and floods are, of course, likely to occur over the next 100 years, there is no evidence to suggest that they would be more frequent, if that is what is implied.

Land subsidence, sea-level rise and coastal wetland loss are serious problems for the Louisiana coast and for New Orleans. However, by focusing on the lowest lying areas of the city, applying unrealistically high rates, and inventing risks that do not exist or are being adequately managed, Kusky greatly exaggerates these threats and advances them in time by centuries. Furthermore, his call for moving the people and infrastructure of New Orleans excludes consideration of coastal restoration options and defense alternatives as well as the social and economic factors that should be involved in such a decision.

Time to move to higher ground

By Timothy M. Kusky |

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New Orleans is one of America's great historic cities, and our emotional response to the disaster is to rebuild it grander and greater than before. However this may not be the most rational or scientifically sound response and could lead to even greater human catastrophe and financial loss in the future.

New Orleans is located on a coastal delta basin up to 10 feet below sea level and still sinking as much as one inch per year. Much of the city could be 18 feet below sea level by the end of the century, or even more if sea level rise becomes significant.

The city has other problems of location. To protect communities along the Mississippi River, the Army Corps of Engineers built a 2,000 mile long system of levees that help prevent river flood waters surging from the channel and inundating low lying areas. However, the levees also channel sediments that normally get deposited on the flood plain and delta far out into the Gulf of Mexico, causing the land surface of the delta south of New Orleans to sink below sea level at an alarming rate. A total land area the size of Manhattan is disappearing every year, meaning that New Orleans will be right on the Gulf Coast by the end of the century.

The projected setting of the city in 2100 is in a hole up to 18 feet below sea level directly on the hurricane-prone coast. The city will look like a fish tank battered by coastal waves, surrounded by 50- to 100-foot-high seawalls that are barely able to protect it from hurricanes that are only as strong as Katrina. Such a city is untenable, and we as a nation need to face this reality.

The levees have an additional collateral effect that may doom the future of New Orleans. A river confined by levees builds its base higher than without levees. Catastrophic floods occur when the river base rises tens of feet above the flood plains, then breaks through the levees. The Chinese know this from their history of flooding along the Yellow River, known as the River of Sorrow after the millions of people who have died there, more than from any other natural disaster in the world. As we consider rebuilding New Orleans we need to remember China's experience.

The Mississippi has over geological time altered its course, with its mouth migrating east and west by hundreds of miles. Each abandoned delta subsides below sea level after the river jumps to another location, as buried muds compact and the river no longer replenishes the delta with sediment. The lower Mississippi now follows a long and circuitous course from the Atchafalaya River junction, through New Orleans, to its mouth near Venice. The river is ready to switch its course to follow the Atchafalaya, offering it a shorter route to the gulf. When this occurs, perhaps triggered by catastrophic flooding and a drenching hurricane, it will be devastating to the lower delta, which will quickly subside. New Orleans will be rapidly inundated by waves and storms from the Gulf of Mexico. To mitigate this hazard the Army Corps maintains an extensive system of diversions, levees, and dams at the Mississippi/Atchafalaya junction, with the aim of keeping the Mississippi in its channel.

New Orleans is sinking further below sea level every year, and the shoreline is rapidly approaching the city. The river is rising, and more hurricanes and floods are certain to strike the region in the next 100 years. The decision whether to rebuild or relocate an historic city is a difficult one. Moving the bulk of the city would be more costly, at least at this stage before sinking increases and another disaster strikes. The costs of either decision will be enormous, but relocating makes more sense and will eventually be inevitable. Whether we cut our losses now and move or wait until a super-hurricane makes a direct hit and kills hundreds of thousands of people must be carefully considered.

One option would be to begin building newer, higher, stronger seawalls around the business and historic parts of the city, and declare other parts a national monument, in tribute to those who lost their lives to Katrina. The process of moving could be gradual, relocating refugees, destroyed businesses, port facilities, and other infrastructure to a new New Orleans.

Katrina (even before Rita) was a warning: New Orleans is sinking unbearably below sea level, and it's time to move to higher ground.

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